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Spectrolaser Application

COAL ANALYSIS

Material North Dakota (USA) coal

Eight samples of commercially mined North Dakota coal were analysed using the Spectrolaser, Laser Plasma Spectrometer. On inspection the samples were found to be coarsely crushed (~<3 mm) and were analysed without further crushing or grinding.

Test Method

Samples for analysis were prepared by placing approximately 6g of coal into the sample holder and pressing to 1 tonne pressure using a LAT 40T hydraulic press. Each coal sample was presented to the Spectrolaser twice to calibrate the instrument and enable the inspection of the resulting calibration curves. Eight portions of one of the coal samples were then presented to the instrument as samples of unknown composition to allow determination of measurement precision and accuracy.

The analysis time is 20 seconds (all elements) for each sample analysed.

Detectable Elements

Detectable elements include the principal coal components (C, H, O and N) in addition to the inorganic components Al, Ba, Ca, Fe, K, Li, Na, Mg, Mn, S, Si, Sr and Ti

Detection Limits

Detection limits are determined from three times the standard deviation in multiple measurements of materials of samples with low analyte concentrations. The estimated detection limits for the principal impurities present in coal are:

Element	Estimated Detection Limit *
Al	0.004 %
Ba	<0.001
Ca	0.001 %
Fe	0.004 %
K	0.002%
Mn	0.001
Mg	0.001 %
Na	0.002%
S	0.1%
Si	0.005 %
Sr	<0.001
Ti	0.001%
C	n.a.

* % as-received (AR)

As with other elemental analysis methods the analysis may be improved further by using additional sample preparation or longer analysis time

Multiple Analysis Test

Expressed in % AR.

Sample CC1325	Al	Ba	Ca	Fe	K	Mn	Mg	S	Si	Sr	Na	Ti	C
1	0.44	0.04	0.76	0.56	0.08	0.003	0.29	0.8	1.3	0.03	0.34	0.04	28.6
2	0.42	0.05	0.78	0.56	0.09	0.003	0.30	1.0	1.3	0.03	0.37	0.04	27.9
3	0.45	0.05	0.72	0.52	0.09	0.004	0.36	1.0	1.2	0.04	0.35	0.03	27.9
4	0.42	0.04	0.77	0.64	0.07	0.003	0.28	1.1	1.0	0.02	0.32	0.03	28.2
5	0.67	0.04	0.85	0.56	0.09	0.004	0.38	1.1	1.4	0.03	0.33	0.05	28.0
6	0.40	0.07	0.76	0.53	0.08	0.003	0.25	1.0	1.1	0.02	0.34	0.04	27.7
7	0.47	0.09	0.73	0.66	0.10	0.003	0.25	1.4	1.4	0.03	0.37	0.03	27.5
8	0.51	0.03	0.80	0.59	0.09	0.004	0.31	1.4	1.4	0.03	0.35	0.04	28.0
Mean	**0.47**	**0.05**	**0.77**	**0.58**	**0.09**	**0.003**	**0.30**	**1.2**	**1.2**	**0.03**	**0.35**	**0.04**	**28.0**
(SD)	0.09	0.02	0.04	0.05	0.01	0.001	0.05	0.1	0.1	0.01	0.02	0.01	0.3
Standard Analysis	**0.46**	**0.051**	**0.79**	**0.56**	**0.08**	**0.003**	**0.05**	**0.7**	**1.3**	**0.03**	**0.31**	**0.03**	**27.3**

EXAMPLE CALIBRATION CURVES